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THE CINNAMON HARVEST-SPIDER AND ITS VARIATIONS.

By Clarence M. Weed.

In his monograph of the Phalangiidæ, published[1] in 1868, Dr. H. C. Wood described a well-marked harvest-spider as *Phalangium ventricosum.* The description was drawn up from a single female taken near Philadelphia, and specimens of a male Phalangium collected in West Virginia supposed to belong to the same species. Besides these Dr. Wood had a number of female harvest-spiders from Nebraska "which present apparently the same specific characters as the former, except that the legs are a little shorter. Suites of specimens from the two localities would however probably show them to be distinct."

In the same paper, Dr. Wood described as *Phalangium formosum* another well-marked form found in spring.

Aside from a mention in 1869 by Dr. Packard in his Guide to the Study of Insects (p. 657), and a bibliographical reference in 1885 by Professor Underwood,[2] these species appear not to have been noticed in our literature for nearly twenty years. Since then, however, I have referred to them in a number of papers.

My first mention was published in 1887[3] when I provisionally referred *P. formosum* to the genus Liobunum, and conjectured, without having seen specimens, that *P. ventricosum* also belonged to that genus. Two years later I published[4] extended descriptions of *P. formosum* referring it to Liobunum "with considerable hesitancy, as it does not strictly belong there on account of the projecting inner angle of the palpal patella."

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[1] Comm. Essex Institute, Vol. VI.

[2] Con. Ent., XVII, 169.

[3] Amer. Nat., XXI, 935.

[4] Bull. Ill. St. Lab. Nat. Hist., III, 91.

These forms were next discussed in my paper on "The Harvest-spiders of North America,"[5] in which *P. ventricosum* is definitely placed in Liobunum, and *P. formosum* together with a southern form not before described is referred to the new genus Forbesium. The new form is named *F. hyemale.* "The former (*F. formosum*) is a distinctly northern species, ranging from New York to Colorado, while the latter (*F. hyemale*) is evidently its southern representative."

Finally in the AMERICAN NATURALIST for September, 1892, I announced that by keeping specimens of *F. formosum* taken in early spring in vivaria, I had determined that it was the immature form of *L. ventricosum*; and about the same time I published[6] extended descriptions of adults of both sexes of *L. ventricosum.*

For the purposes of the present study I have had a considererable number of adult specimens from nine widely separated states, viz.; Maine, New Hampshire, New York, Ohio, Michiigan, Illinois, Nebraska, North Carolina and Mississippi. Besides the adults I have had an immense number of the immature form (*formosum*) and a few of the form at present called *F. hyemale.*

The first glance at the adult specimens shows that there is a great variation in the size of the body and length of legs in different localities. The Mississippi forms are twice as large as those from New Hampshire; while those from the states between present intermediate sizes. This is shown by the measurements in millimeters in the following table; numbers 1 to 6 are males, and 7 to 12 females.

To show graphically the gradual lengthening of the legs of this harvest-spider as it goes southward I have reduced the length of the second pair, as given in this table, to the straight lines reproduced on the opposite page. The Mississippi specimens were taken at the Agricultural College in the central part of the state. I regret that I have not more specimens from the region between Ohio and Mississippi to show the transition more completely.

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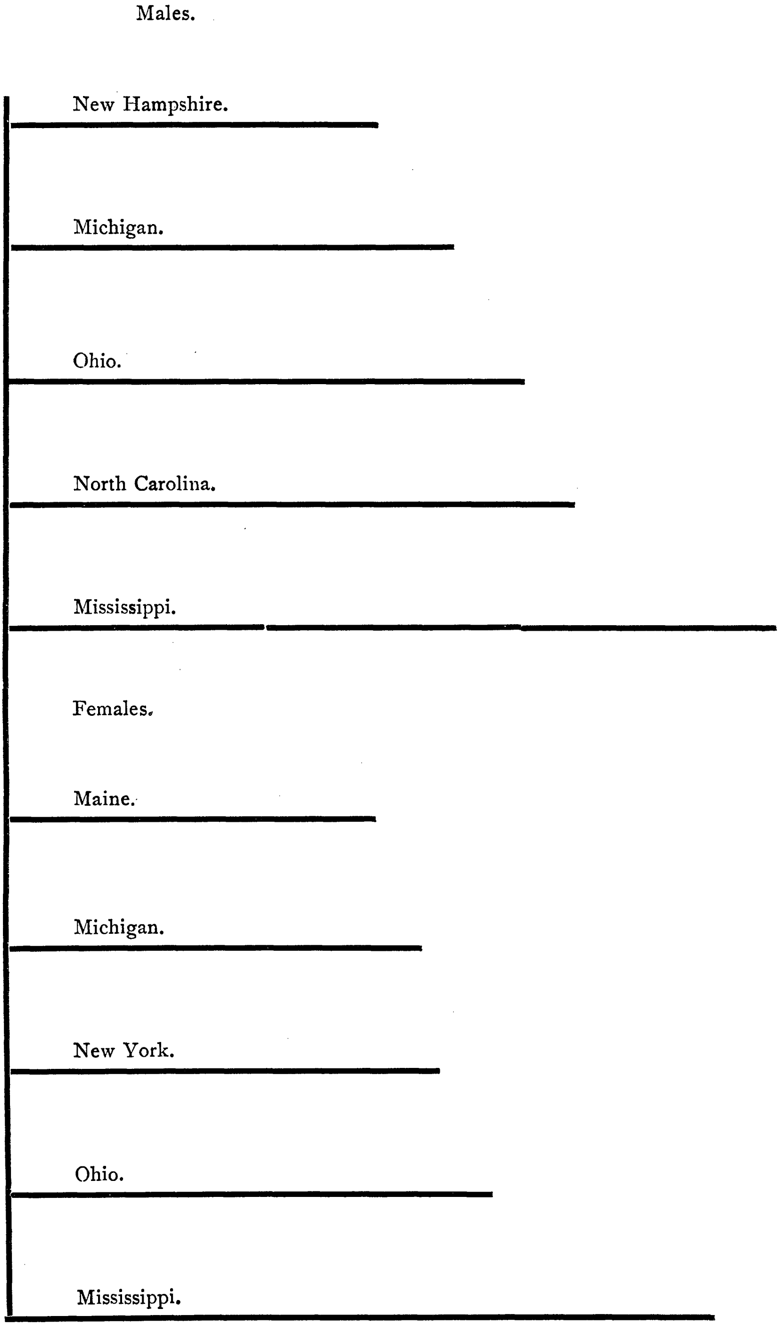
[5] Am. Nat., Oct., 1890.

[6] Trans. Am. Ent., Soc., XIX, 188.

Table I.—Variations of *Liobunum ventricosum.*

Number of Specimen.	Locality	Body.		Legs.			
		Length	Width	First	Second	Third	Fourth
1	New Hampshire	5.8	4.	27.5	47.5	28	36.5
2	Michigan	7.	4.4	27.5	55.5	26	42.
3	"	7.1	4.2	28.	57.5	29	44.6
4	Ohio	7.6	5.	36.5	67.5	36	—
5	North Carolina	8.	5.	44.	74.	—	—
6	Mississippi	9.	6.	52.	101.	50	73.
7	Maine	9.	5.6	25.	47.	24	—
8	New York	10.2	5.5	27.8	55.	27	39.
9	Michigan	10.	6.	28.	53.	28	40.
10	Ohio	10.	6.	—	62.	—	48.6
11	Mississippi	13.4	7.	46.	89.	44	—
12	"	11.	6.2	48.	93.5	46	68.


Males.
New Hampshire.
Michigan.
Ohio.
North Carolina.
Mississippi.
Females.
Maine.
Michigan.
New York.
Ohio.
Mississippi.

Like other harvest-spiders this species also varies considerably in a given locality. It is so rare that it is difficult to get long series from one place so that I cannot tabulate at present these variations as fully as has been done for *Phalangium cinereum* and *Liobunum vittatum dorsatum.*[7] To indicate the variation that sometimes occurs in a single state I may record that of two specimens from Dover, New Hampshire, measured since the above tables were prepared, the body of the male was 8 mm. long, and the second legs 63 mm., while the body of the female was 10 mm. long, and the second legs 50 mm. The second legs of this male specimen were 15.5 mm. longer than the one from Hanover recorded in the table. It should be stated however that Dover is distinctly within the region of the Alleghanian fauna, and Hanover is on the border between the Alleghanian and Canadian faunas.

A study of all the specimens of my *Forbesium hyemale* now accessible leads to the conclusion that this is the immature stage of the southern form of *L. ventricosum,* just as Wood's *P. formosum* is the immature stage of the northern form of this species. The dissection of specimens shows that they are not sexually mature, and the dates of capture indicate that they disappear late in spring or early in summer at the time the

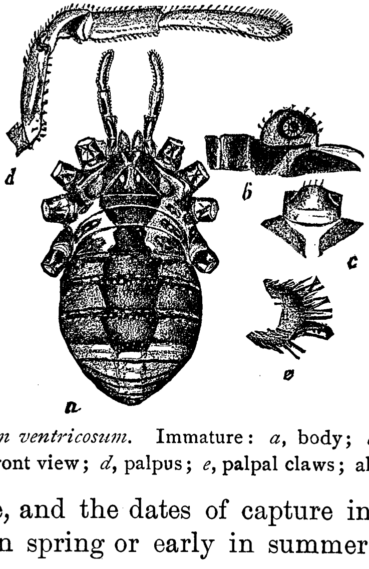


FIGURE 1.—*Liobunum ventricosum.* Immature: *a*, body; *b*, eye eminence, side view: *c*, same, front view; *d*, palpus; *e*, palpal claws; all magnified.

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[7] AMERICAN NATURALIST, Vol. XXVI, pp. 34–36.

adult *L. ventricosum* appear. This is precisely the condition in the northern states. An idea of the similarity of the two immature forms in structural details may be obtained by comparing Fig. 1 with Plate XIV, Fig. 2.

The southern form of *L. ventricosum* should evidently be considered a geographical race sufficiently distinct for subspecific name. Inasmuch as *hyemale* has already been applied to the stage immediately preceding the adult it may well be used for this race, and the form be known as *Liobunum ventricosum hyemale.* Just where the line dividing the two forms should be drawn is difficult to say without more material, but it probably occurs near the latitude of southern Ohio.

LAWS OF VARIATION IN HARVEST-SPIDERS.

Comparatively little definite investigation of the geographical variation of North American invertebrates has yet been undertaken. In the vertebrates—especially birds and mammals—much attention to the subject has been given by Baird, Allen and other well-known zoologists, so that a number of general laws have been formulated.[8] To determine to what extent these laws hold true for the invertebrates, as represented by the Phalangiidæ, I have ventured to formulate some of the results obtained in my studies of this group—results which in part have already appeared in the NATURALIST and in part are yet unpublished. At the present stage of investigation such formulæ cannot be considered as final by any means, but if they serve no other purpose they will be useful in determining the direction of future work.

(1.) In mature individuals of the same species and sex from a given locality there may be found a decided variation in size of body and length of legs. In a series of fifty or a hundred such individuals taken at random the body of the largest specimen will usually be from one-fifth to one-fourth longer than that of the smallest; and the legs of the longest-legged individual are likely to be from one-fifth to one-third longer than those of the shortest-legged specimen.

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[8] See the AMERICAN NATURALIST, Vol. XXVI, pp. 87–89.

(2.) As a rule, not without exceptions, the legs vary together in a given direction; that is, if in a certain individual the first pair are longer than the first pair of another individual, the other legs of the former are likely to be longer than the corresponding legs of the latter. The hind legs are the most irregular in their variation.

(3.) There is a gradual increase in size of body and length of legs in the individuals of a species from the north, southward at least as far as latitude 37° in the Mississippi Valley near which region the sub-family Phalangiinæ appears to attain its maximum development.

(4.) The proportionate increase in the length of the legs to the southward appears to be greater than that of the body.

These last two propositions are true of all the harvest-spiders having an extended northern and southern distribution studied with reference to their variations, viz; *Liobunum vittatum*, *L. ventricosum*, *L. politum* and *L. longipes*. Probably the most important factor in determining this increase in size is to be found in the climatic conditions which permit a longer period of growth and feeding at the south than in the north. The arachnids undergo no definite series of molts, simply casting their skins as increase in size requires. Such climatic conditions, combined presumably with a more abundant food supply, may tend, apparently, to increase the size of these harvest-spiders by at least three methods:

(*a*.) By the direct effect of a long warm period of growth with abundant food upon the individual before attaining its full size.

(*b*.) By the effect of a long period of development of the eggs in the ovaries of the female.

(*c*.) By the action of the eliminating principle in natural selection in fostering those individuals which attain the maximum size compatible with their environment.

This increase in size of individual may possibly be of benefit to the species (1) by enabling it to prey upon larger insects, thus increasing the source and variety of its food-supply; (2) by enabling it better to elude predaceous enemies, or (3) to catch fleeing prey.

PLATE XIV.

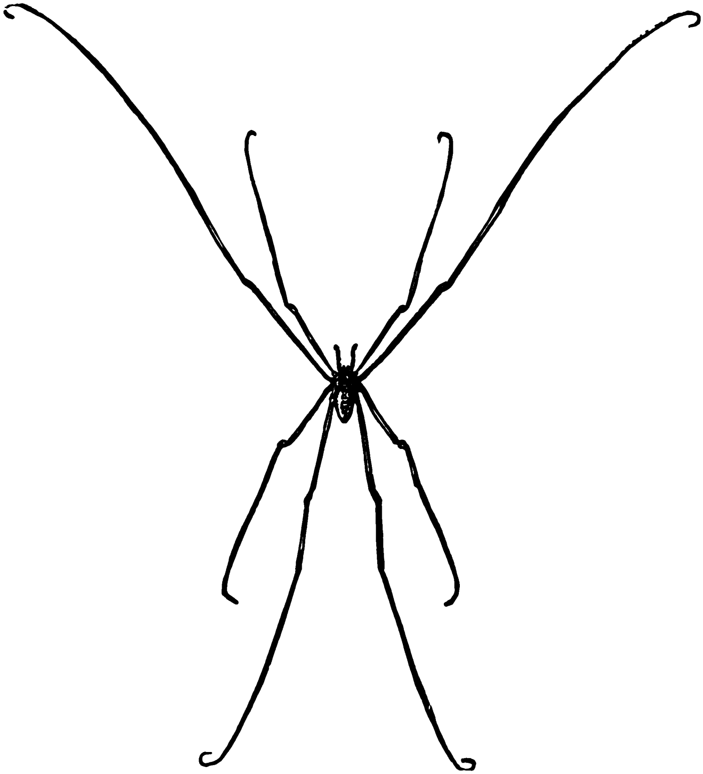

Fig. 1.

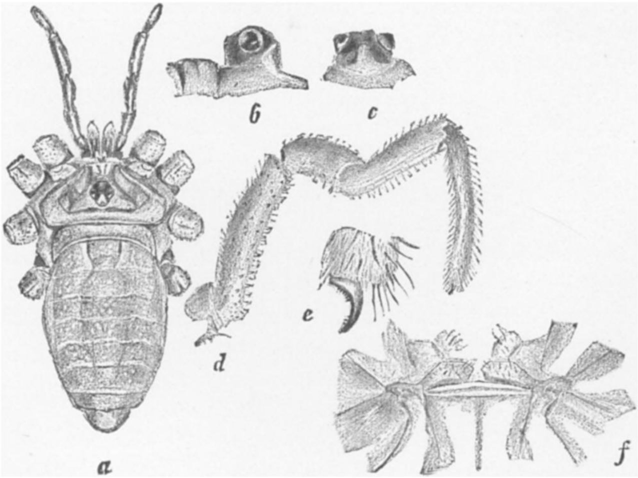

Fig. 2.

Liobunum ventricosum (Wood.)

(4.) In the plains region of the Northwest (Dakota, Nebraska) the legs are considerably shorter than in similar latitudes in New England.

For example, the second legs of a male *Liobunum longipes* from Brookings, South Dakota, measure 62 mm., while those of a Hanover, New Hampshire specimen measure 74 mm. The case of the Striped Harvest-spider (*L. vittatum dorsatum*) is still more striking; the second legs of a New Hampshire specimen measure 71 mm., while the normal length in South Dakota seems to be only 35 mm.

In addition to the above the following laws of vertebrate variation appear to hold good in the Phalangiidæ.

(5.) " The maximum physical development of the individual is attained where the conditions of environment are most favorable to the life of the species.

(6.) " The most typical or most generalized representatives of a group are found near its center of distribution, outlying forms being generally more or less aberrant or specialized."

Explanation of Plates.

Plate XIII. Fig. 1.—*Liobunum ventricosum* (Wood), male. Natural size.
" 2.—Parts of same. Magnified.
" 2*a*.—Body.
" 2*b*.—Eye eminence. Side view.
" 2*c*.—Eye eminence. Front view.
" 2*d*.—Palpus. Side view.
" 2*e*.—Claw of palpus. Side view.
" 2*f*.—Maxillary lobe of second pair of legs.

Plate XIV. Fig. 1.—*L. ventricosum hyemale.* Immature. Natural size.
" 2.—Parts of same. Magnified.
" 2*a*.—Body.
" 2*b*.—Eye eminence. Side view.
" 2*c*.—Eye eminence. Front view.
" 2*d*.—Palpus. Side view.
" 2*e*.—Claw of palpus. Side view.